Chemical Reactions Investigation Lab; SC1b, SC2b

Objectives:

- Observe and record chemical changes involving chemicals found in common products.
- Design and carry out experiments to identify chemicals in consumer products
- Demonstrate the use of the names and formulas of common chemical compounds.

Introduction: Chemistry is a science that investigates changes in matter. Chemical reactions are the changes matter undergoes. The changes you can observe are called "macroscopic" changes. Often these changes, such as color changes, the formation of a solid, or the formation of gas bubbles, are visible. Thus, though we cannot see the atoms and molecules reacting, we can see indications that chemical changes have taken place. Different atoms and molecules often react in different ways. Chemistry attempts to explain macroscopic changes in terms of the behavior of atoms and molecules, that is, on the submicroscopic level. You can use these different reactions to detect the presences of specific kinds of chemicals in mixtures. In this lab you will study some reactions of common chemicals contained in consumer products. The purpose of this lab is to observe the microscopic changes in terms of submicroscopic changes and to relate these changes to the behavior of atoms and molecules. As the name implies, submicroscopic changes are changes we cannot see, even with a microscope. The essence of understanding chemistry is to infer from macroscopic changes the submicroscopic behavior of atoms and molecules. **Safety:** Wear your safety glasses and use full small-scale pipets only for the carefully controlled delivery of liquids.

Materials:

Sodium Hydrogen Carbonate ($NaHCO_3$)	Blue Dye (Methylene Blue or BTB)	Potassium Iodide (KI)	Calcium Chloride ($CaCl_2$)
Sodium Carbonate (Na_2CO_3) if available	0.5 M Sodium Hydroxide (NaOH)	Ammonia (NH_3)	0.5 M Hydrochloric Acid (HCl)
Sodium Hypochlorite (NaClO)	Lead II nitrate ($Pb(NO_3)_2$	Bromothymol Blue (BTB)	Phenolphthalein (PHEN)
Silver Nitrate ($AgNO_3$)	Copper II Sulfate ($CuSO_4$)	Starch Solution	Copious water

Post Lab Questions:

1. Sodium hydrogen carbonate is baking soda, $NaHCO_3$. When HCl is added to $NaHCO_3$, carbon dioxide bubbles are formed. Do you know the chemical formula of carbon dioxide? In what consumer product is the gas commonly found?
2. Which of the other mixings formed bubbles?
3. What do you think the gas is that results from question 2?
4. The body uses hydrochloric acid, HCl, to help digest food. Where in the body is hydrochloric acid found? What color does it turn the blue food dye?
5. Sodium hypochlorite, NaClO, is a common ingredient in household bleaches and cleaners. What happened to the color of the the blue dye when both HCl and NaClO was added?
6. Potassium Iodide, KI, is the source of iodine in iodized salt. What color is the KI + NaClO mixture? What color does starch change to in the presence of KI and NaClO?
7. A precipitate is a solid that separates upon mixing solutions. Which reaction made a bright yellow precipitate?
8. Which other mixings produced precipitates?
9. Which mixture produced a precipitate very slowly?
10. Which solutions produced a muddy brown precipitate?
11. Observe the scrap paper you used to absorb the $AgNO_3$ + NH_3 mixture. What evidence do you see that indicates that silver compounds are light sensitive?
12. Review your results and list at least three different kinds of changes that indicate that a chemical reaction is occurring.

Unless copies are provided, transcribe the following data table onto your sheet of paper. Make the data table as large as possible to include detailed qualitative data. Use small-scale pipets to put 2 drops of each chemical into a small petri dish, clear spot plate or a glass watch glass. Slide the dish or plate onto the X's in the indicated spaces below to view the reactions. Stir each mixture by squeezing air through your empty pipet. Record your qualitative data in table 1.1.

Experimental Data Table 1.1 (qualitative)

a.		$NaHCO_3$ + HCl	h.		NH_3 + Bromothymol Blue (BTB)
b.		HCl + Bromothymol Blue (BTB)	i.		$NaHCO_3$ + PHEN
c.		Blue Dye (BTB) + NaClO Now add 1 drop HCl	j.		PHEN + NaOH
d.		NaClO + KI Now add 1 drop starch solution	k.		NaOH + $AgNO_3$
e.		KI + $Pb(NO_3)_2$ (stereoscope)	l.		$AgNO_3 + NH_3$ Absorb onto scrap of paper and expose to sunlight: Tape to your data table
f.		$Pb(NO_3)_2$ + $CaCl_2$ (stereoscope)	m.		NH_3 + $CuSO_4$
g.		2HCl + 1 PHEN +1 more PHEN	N		$CuSO_4$ + $NaHCO_3$

Experimental Page:
Use small-scale pipets to put 2 drops of each chemical into a small petri dish, clear spot plate or a glass watch glass. Slide the dish or plate onto the X's in the indicated spaces below to view the reactions. For background contrast, view the drops on black and white backgrounds provided by the X's. Stir each mixture by squeezing air through your empty pipet. Record your qualitative data in table 1.1.

a.	X	$NaHCO_3$ + HCl	h.	X	NH_3 + Bromothymol Blue (BTB)
b.	X	HCl + Bromothymol Blue (BTB)	i.	X	$NaHCO_3$ + PHEN
c.	X	Blue Dye (BTB) + NaClO Now add 1 drop HCl	j.	X	PHEN + NaOH
d.	X	NaClO + KI Now add 1 drop starch	k.	X	NaOH + $AgNO_3$
e.	X	KI + $Pb(NO_3)_2$	l.	X	$AgNO_3 + NH_3$ Absorb onto scrap of paper and expose to sunlight: Tape to your data table
f.	X	$Pb(NO_3)_2$ + $CaCl_2$ (stereoscope)	m.	X	NH_3 + $CuSO_4$
g.	X	2HCl + 1 PHEN +1 more PHEN	N	X	$CuSO_4$ + $NaHCO_3$